Arkoma Woodford Shale Overview
AADE Symposium 2009

Scott Schmidt  Drilling Engineer
Arkoma Woodford Development

- General overview of area
- Lithology
- Activity History
- Challenges in each hole section
- Solutions
Woodford Shale

- Lithology: Multi component shale
- Fractures: Multiple scales
- Porosity: 3 – 6.5% primary
- Permeability: 200 nd (avg.)
- Reservoir Thickness: 175 feet
- Drill depth: 7,500 feet
Area Seismic  NW to SE

NW  RUSSELL 1-34  DSR 1-18  McPHETRIDGE 1-28  SIDMORE 8-35

SE

HRSR
ATOK
WPCK
WDFD
VIOLA

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## Arkoma DVN Wells

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Vertical Hole Section

- **Challenges**
  - **Hole Stability, Lost Circulation, Formations**
    - Very Water Sensitive, Sloughing, Hole Stability Issues
    - Lost Circulation in Upper Part of Atoka
    - Wapanuka LS, 30Kpsi UCS, hard transition from shale (PDC)
    - Cromwell SS ~27Kpsi UCS, continues bit damage from upheole
  - **Solutions**
    - OBM for less severe loss areas
    - Intermediate 9-5/8” CSG and WBM in theft areas
    - Drilling practices, limit ROP and RPM in transition zones with PDC
    - Retain more cutter life with good practices upheole
Curve/Build Hole Section

- Challenges
  Formations, BURs, Bit life, TF Control
- Top of Curve Section - Caney Shale, Woodford top
  - BUR 8° - 10°, BUR hard to achieve in softer shale
  - 2 TCIs to complete curve section
  - Interbedded Formation makes TF control difficult w/ PDC
  - Kickpad problems when using PDC
- Solutions
  - Use kickpad with TCI to achieve BUR needed
  - LS mtr decreases Krevs while giving acceptable ROP, bit life
  - PDC somewhat successful in cleaner lithology
  - PDC will not drill top layer of Woodford w/o trip, BUR, use TCI
Lateral Section (Woodford Sh)

- **Challenges**
- **Formation Content, Hole Cleaning, Geology/Faulting**
  - Imbedded Chert and Qtz. nodules scattered randomly in Shale
  - Cuttings beds in long laterals creates problematic trips
  - Faulting/Karsts in formation- out-of-zone drilling
- **Solutions**
  - Diamond-enhanced TCIs and heavy set PDCs for high chert content areas when possible
  - Patience, strict adherence to circulation, hole cleaning and trip techniques helps makes tripping uneventful
  - Geosteering corrections after faults, following dip angle,
Well Profile and Formations
Tangent Vertical Section

Harshorn Coal
Atoka Shale

3082' MD: KOP1 1.5°/100' DLS

3815' MD: EOB w/11'

5479' MD: Start Drop 1.5°/100' DLS

6213' MD: EOD w/0°

6313' MD: KOP2 8°/100' DLS

7154' MD: 67.35° @ Woodford Top

7444' MD: Land w/90.5°

13944' MD: PHEL

330' Hard Line

SECTION DETAILS

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Other Solutions for Success

• Overall Well Solutions/Improvement
  - People
    • Crews, Consultants, Office
  - Equipment
    • Rigs, Directional, Fluids, Bits
  - Teamwork between all brings safety and efficiency
Thank You.